

Appl. No. 10/840,211
Amdt. dated March 16, 2006
Reply to Office action of Dec. 19, 2005

IN THE SPECIFICATION:

Please replace paragraph [0001] with the following amended paragraph:

[0001] This invention relates generally to the retaining against relative axial movement of two members in telescopic relation with a shaft. The members are retained by a retaining element received in an external groove on the shaft. In particular, the invention relates to a retaining element for retaining a wheel hub and a ~~new-generation~~ wheel bearing assembly, without preload upon a shaft of an outboard drive axle of an automotive vehicle.

Please replace paragraph [0008] with the following amended paragraph:

[0008] According to another aspect of the invention, an assembly having a retaining element, an outer race of a constant velocity joint, and a shaft of an outboard drive axle that is axially joined to the outer race is provided. The shaft has an external groove circumferentially formed on its external surface for receiving the retaining element. The external surface of the shaft supports a ~~new-generation~~ wheel bearing assembly and a wheel hub that is non-rotatably coupled to the external surface of the shaft. The retaining element engages the external groove of the shaft and retains the wheel hub and bearing not requiring a preload. The wheel hub is assembled between the retaining element and the wheel bearing. In this arrangement the wheel bearing assembly is retained between the wheel hub and the outer race of the constant velocity joint, thereby allowing the retained wheel hub to be rotatably drivable within the wheel bearing assembly by the constant velocity joint.

Please replace paragraph [0021] with the following amended paragraph:

[0021] The assembly 10 further comprises a steering knuckle or bearing support 26 having a third bore 28 and a backstop 30, a retaining ring 32 and a wheel bearing assembly 16. The wheel bearing assembly 16 is a ~~new-generation~~ type of wheel

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bearing known as roll-formed or self-contained bearing and does not require a preload. The wheel bearing assembly 16 has an outer part 34 rotatably coupled by a plurality of bearing elements (not shown) to an inner part 36, where the inner part 36 has a second bore 42, a first side 38 and a second side 40 (all not detailed). The wheel bearing assembly 16 is fit into the third bore 28 up to the backstop 30 of the steering knuckle 26 and retained by the retaining ring 32 between the backstop 30 and the retaining ring 32. The outer part 34 of the wheel bearing assembly 16 is non-rotatably coupled to the third bore 28 of the steering knuckle 26. The inner part 36 of the wheel bearing assembly 16 is non-rotatably coupled to the shaft 12 of the outboard drive axle 13 where the first side 38 of the wheel bearing assembly 16 is assembled adjacent to the outer race 18.

Please replace paragraph [0025] with the following amended paragraph:

[0025] Figure 2 is a partial cross-section of a shaft [[12,]] 112, wheel hub [[14,]] 114, and wheel bearings 16 of an outboard drive axle assembly [[10]] 110 according to another embodiment of the invention. The assembly [[10]] 110 comprises an outer race 18 of a constant velocity joint 20, a shaft [[12]] 112 of an outboard drive axle 13 which is axially coupled to the outer race 18. The shaft [[12]] 112 has an external surface [[22]] 122 and an external groove [[24]] 124 circumferentially formed in the external surface [[22]] 122 of the shaft [[12]] 112 for retaining the wheel hub [[14]] 114.

Please replace paragraph [0026] with the following amended paragraph:

[0026] The assembly [[10]] 110 further comprises a steering knuckle or bearing support 26 having a third bore 28 and a backstop 30, a retaining ring 32 and a wheel bearing assembly 16. The wheel bearing assembly 16 is a ~~new-generation~~ type of wheel bearing known as roll-formed or self-contained bearing and does not require a preload. The wheel bearing assembly 16 has an outer part 34 rotatably coupled by a plurality of bearing elements (not shown) to an inner part 36, where the inner part 36 has a second bore 42, a first side 38 and a second side 40 (all not detailed). The wheel bearing assembly 16 is fit into the third bore 28 up to the backstop 30 of the steering

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knuckle 26 and retained by the retaining ring 32 between the backstop 30 and the retaining ring 32. The outer part 34 of the wheel bearing assembly 16 is non-rotatably coupled to the third bore 28 of the steering knuckle 26.

Please replace paragraph [0027] with the following amended paragraph:

[0027] The wheel hub [[14]] 114 has an internal groove [[52]] 152, a first bore [[44,]] 144, a radially extending flange [[46]] 146 for attaching a wheel, and an outer surface [[48]] 148. The inner part 36 of the wheel bearing assembly 16 is non-rotatably coupled to the outer surface [[48]] 148 of the wheel hub [[14]] 114. The first side 38 and second side 40 of the inner part 36 of the wheel bearing assembly 16 is assembled between the outer race 18 of the constant velocity joint 20 and the flange [[46]] 146 of the wheel hub [[14,]] 114, respectfully.

Please replace paragraph [0028] with the following amended paragraph:

[0028] The assembly [[10]] 110 also comprises a retaining element 50 for retaining the assembly without preload. The first bore [[44]] 144 of the wheel hub [[14]] 114 is non-rotatably coupled to the external surface [[22]] 122 of the shaft [[12]] 112 and is held in an assembled position between the outer race 18 of the constant velocity joint 20 and the retaining element 50. The retaining element 50 engages cooperating grooves, the external groove [[24]] 124 of the shaft [[12]] 112 and the internal groove [[52]] 152 of the wheel hub [[14,]] 114, retaining the wheel hub [[14]] 114 to the shaft [[12]] 112. The retained wheel hub [[14]] 114 is rotatably drivable within the steering knuckle 26 by the constant velocity joint 20.

Please replace paragraph [0030] with the following amended paragraph:

[0030] It is also contemplated that the external groove [[24]] 124 may be located outwardly, nearer the opposite end of the shaft from the outer race, upon the external surface in the coupling section of the shaft. The wheel hub and the shaft may be held in

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an assembled position by the retaining element. The retaining element 50 of this contemplated embodiment may be an external type of retaining device such as an external snap ring.

Please replace paragraph [0031] with the following amended paragraph:

[0031] Figure 3 is a partial cross-section of a shaft 12 of an outboard drive axle 13 having an external type of retaining element 50 according to ~~one embodiment of the invention~~ the embodiment shown in Figure 1. The assembly of the outboard drive axle 13 includes an outer race 18 of a constant velocity joint 20 axially coupled to a shaft 12. The shaft 12 has an external surface 22 and an external groove 24 circumferentially formed in the engagement section 54 of the external surface 22. The assembly of the outboard drive axle 13 is shown here having a retaining element 50 assembled in the external groove 24 on the shaft 12.

Please replace paragraph [0033] with the following amended paragraph:

[0033] Figure 4 is a partial cross-section of a shaft [[12]] 212 of an outboard drive axle [[13]] 213 having internal retention capabilities according to one embodiment of the invention. The assembly of the outboard drive axle [[13]] 213 includes an outer race 18 of a constant velocity joint 20 axially coupled to a shaft [[12]] 212. The shaft [[12]] 212 has an external surface [[22]] 222 and an external groove [[24]] 224 circumferentially formed in the non-engagement section [[56]] 256 of the external surface [[22]] 222.

Please replace paragraph [0034] with the following amended paragraph:

[0034] The external groove [[24]] 224 is capable of receiving a retaining element 50 that is either an external type or internal type of retention. An external retaining element 50 would include a spring ring or snap ring that expands in order to slip over the shaft [[12]] 212 and retracts, when released, to engage the external groove [[24]] 224 and may retain the wheel hub [[14]] 214. An internal retaining element would

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include a spring ring or snap ring that is compressible within the external groove [[24]] 224 and regains shape upon being released for co-operatively engaging the grooves 24, 52 224, 152 of the shaft [[12]] 212 and wheel hub [[14,]] 214 respectfully, as shown in Figure 2. The retaining element 50 can be a snap ring and other compatible retention devices known to those in the art.

Please replace paragraph [0035] with the following amended paragraph:

[0035] The engagement section [[54]] 254 of the shaft [[12]] 212 may have a plurality of spline or other engagement surfaces known to one in the art for non-rotatably coupling or inter-engaging with another part.

Please replace paragraph [0040] with the following amended paragraph:

[0040] Figure 6 is a partial cross-section of a shaft [[12,]] 312, wheel hub [[14,]] 314, and wheel bearings [[16]] 316 of an outboard drive axle assembly according to another embodiment of the invention. The assembly has an outer race 18 of a constant velocity joint that is axially coupled to a shaft [[12]] 312. The shaft [[12]] 312 has an external groove [[24]] 324 circumferentially formed in its external surface and is capable of receiving a retaining element 50. The wheel hub [[14]] 314 has an internal groove [[52]] 352 capable of receiving the retaining element 50 as shown in this embodiment. The assembly of this embodiment also shows a bearing support or steering knuckle [[27]] 327 rotatably coupled by a wheel bearing assembly [[16]] 316 to the wheel hub [[14]] 314. The wheel bearing assembly [[16]] 316 is a new-generation type of wheel bearings, known as roll-formed or self-contained bearing and does not require a preload. The retaining element 50 retains the assembly without imparting preload upon the bearings. The wheel hub [[14]] 314 is non-rotatably coupled, e.g., splined, to the shaft [[12]] 312 and held in an assembled position by the retaining element 50. The retaining element 50 engages cooperating grooves, the external groove [[24]] 324 of the shaft [[12]] 312 and the internal groove [[52]] 352 of the wheel hub [[14,]] 314, retaining

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the wheel hub [[14]] 314 to the shaft [[12]] 312. The retained wheel hub [[14]] 314 is rotatably drivable within the steering knuckle [[27]] 327 by the constant velocity joint.

Please replace paragraph [0041] with the following amended paragraph:

[0041] The retaining element 50 of this embodiment is an internal type of retaining device such as an internal snap ring. It is also contemplated that the external groove [[24]] 324 may be located outwardly, nearer the opposite end of the shaft from the outer race, upon the external surface in the coupling section of the shaft, wherein the wheel hub and the shaft may be held in an assembled position by the retaining element. The retaining element 50 of this contemplated embodiment may be an external type of retaining device such as an external snap ring.